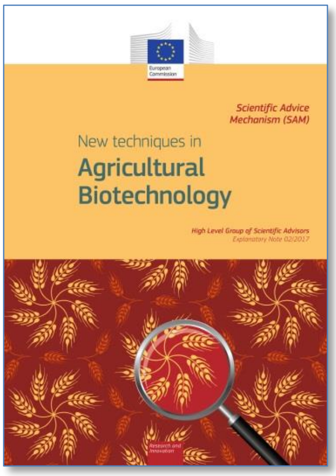
European Commission

# Citizen's Summary

## *Explanatory Note*
## *New Techniques in Agricultural Biotechnology*




### What is the note about?

The invention of agriculture around 10,000 years ago gave access to vast new food and energy resources, dramatically transforming the way we lived. Ever since, human beings have endeavoured to improve their crops and animals. In doing so, we have selected plants, animals and microorganisms that give a greater yield, are more palatable, easier to process, *etc*. These are known as desirable traits.

For many years, this selection of desirable traits happened when farmers collected and planted seeds from more vigorous plants, or mated specific animals (processes known as conventional breeding techniques, CBT). Because these traits are a result of an organism's genetic makeup, when this kind of selection takes place over an extended period the genetic profile of a population of organisms changes. The offspring of individuals within that population increasingly display the desired characteristics or traits.

The ways in which organisms with desirable traits can be selected has become more sophisticated as technology has developed. At first, chemical or physical agents (such as x-rays) were used to make random changes to plant seeds (in a process known as induced mutagenesis) in the hope that some changes would result in desirable traits. More targeted genetic modification (GM) became possible during the 1980s, typically involving the insertion of genetic material into organisms, some of which may be from other species. This introduced genetic material can sometimes be transferred to offspring, or might only be present in a single generation. While the identity of the inserted genetic material is controlled, the location of its insertion usually cannot be controlled.

More recently, a variety of new breeding techniques (NBT) have found their application in agricultural biotechnology. Some of these techniques do not lead to the inclusion of genetic material from other species or to changes of genetic sequences, while others do. When changes to genetic sequences are made, they are typically made in a more precise manner than those made with the established techniques of genetic modification (ETGM) described above.

There is debate in Europe and elsewhere about the extent to which human biotechnological intervention in agricultural genetics is desirable. Some believe that biotechnological intervention creates unacceptable environmental and human health risks, or that it is unethical to interfere with genetics. Others believe that biotechnological innovation can help to solve challenges including those related to food insecurity and poor nutrition, and can provide economic and ecological benefits.

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The explanatory note describes and compares different groups of agricultural biotechnologies from a scientific, not legal, point of view. It describes conventional breeding techniques (CBT), established techniques of genetic modification (ETGM) and new breeding techniques (NBT). It compares these techniques (CBT with ETGM; and ETGM with NBT) according to a variety of criteria. It results from a scoping paper detailing the request from the College of European Commissioners to the High Level Group of Scientific Advisors.

## What does the explanatory note say?

- All living organisms are subject to alterations in their genetic information, occurring spontaneously and due to environmental stressors. These changes are the basis for evolution by natural selection. All breeding techniques (CBT, ETGM and NBT) make use of genetic diversity and change in order to allow the selection of desirable traits.

- CBT, ETGM and NBT vary in terms of: the precision with which desired changes can be made (and therefore in the extent to which they produce unintended effects); the extent to which these changes can subsequently be detected and attributed to a particular technique and; in terms of the presence or otherwise of genetic material from other organisms of other species.
    - Broadly speaking, NBT are more precise and result in fewer unintended effects than do CBT and ETGM.
    - Unintended effects are however not by definition visible or harmful, either to the organism in question, or to those who eat it, or who eat or use its products. Furthermore, it is not possible to talk about the safety of techniques solely based on their precision and the likelihood that they will produce unintended effects. Safety assessments can only be made on a case-by-case basis and depend on the features of the end product or organism.
    - Generally speaking, while organisms produced using CBT will never contain genetic material from organisms of other species, those produced using ETGM usually will, and those produced using NBT may or may not.
    - Similarly, without prior knowledge of the changes made by any technique, changes are difficult to detect and the attribution of changes to a particular technique is generally impossible.

- There is very large variation within the group of NBT, in terms of their molecular mechanisms; the size, location and frequency of the genetic changes they make; the extent to which they make use of ETGM in intermediate stages; and in whether or not their end products contain genetic material from other organisms. For example:
    - Genome editing NBT can produce precisely located alterations to genetic sequences.
    - Other NBT, such as RNA-dependent DNA methylation make no changes to genetic sequences at all.
    - The end products of NBT do not necessarily contain genetic material from other organisms. Genetic material from other organisms may be present in intermediate stages.

## What happens now?

The explanatory note was presented at the European Commission organised conference, "Modern Biotechnologies in Agriculture: Paving the way for responsible innovation", 28 September 2017. The overall aim of the conference was to stimulate an informed and open debate among all stakeholders on how the EU can benefit from modern biotechnologies and innovation in the food and agricultural sector while maintaining high safety standards.



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